CLAIMS:

1. A metal flow system for use in pressure casting of magnesium alloy in a molten or thixotropic state, using a pressure casting machine having a mould or die which defines a die cavity, wherein the system includes a die or mould tool means which defines at least one runner of the system from which molten magnesium alloy is able to be injected into the die cavity, and wherein the flow system is of a form providing for control of metal flow velocities therein whereby substantially all of the metal flowing throughout the die cavity is in a viscous or semi-solid state.

2. A system according to claim 1, wherein the system includes at least one controlled expansion region of the system in which region in the metal flow is able to spread laterally, with respect to its direction of injection, with a resultant reduction in its flow velocity relative to its velocity in the runner.

3. A system according to claim 2, wherein the controlled expansion region comprises at least one gate through which the metal is able to flow from the runner to the die cavity.

4. A system according to claim 3, wherein the gate and runner are such that an effective cross-sectional area of flow through the gate exceeds an effective cross-sectional area of flow through the runner whereby the molten metal has a velocity through the effective cross-sectional area of flow through the runner which exceeds its velocity through the gate.

5. A system according to claim 4, wherein the cross-sectional area of flow through the gate preferably exceeds the effective cross-sectional area of flow through the runner to an extent providing for a ratio of those areas in the range of about 2:1 to 4:1.

6. A system according to claim 2, wherein the controlled expansion region is defined at least in part by and within the die cavity, by surfaces defining the cavity adjacent a site at which metal enters the cavity.

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7. A system according to claim 6, wherein there is a gate at the site, with the gate providing an outlet end of the runner without defining part of the controlled expansion region.

8. A system according to claim 6, wherein there is a gate at a site, with the gate defining part of the controlled expansion region.

9. A system according to any one of claims 2 to 8, wherein provision of the controlled expansion region is achieved by a step-wise increase in cross-section from the effective cross-section of the runner.

10. A system according to any one of claims 2 to 8, wherein the controlled expansion region progressively increases in cross-section in the direction of metal flow therethrough.

11. A system according to any one of claims 1 to 10, wherein the system is adapted for use in pressure casting with a given machine with which it is operable to achieve a velocity of molten metal through the runner with the range of about 140 m/s to 165 m/s.

12. A system according to claim 11, wherein the velocity in said range is about 150 m/s.

13. A system according to claim 11 or claim 12, as appended to any one of claims 2 to 10, wherein the system is operable to achieve a velocity of flow of molten metal through the controlled expansion region which is about 25% to 50% less than the velocity of flow through the runner.

14. A system according to claim 13, wherein the velocity through the controlled expansion region is about two-thirds of the velocity through the runner.

15. A system according to any one of claims 1 to 14, wherein the runner has a designed cross-sectional area which substantially defines the effective cross-sectional area of flow therethrough.

16. A system according to any one of claims 1 to 15, wherein said system is operable to achieve filling of the die cavity by moving semi-solid fronts of metal.

17. A process for producing a casting of a magnesium alloy, wherein the magnesium alloy is cast in a molten or thixotropic state, using a pressure casting machine having a mould or die which defines a die cavity, and using a metal flow system which includes a die or mould tool means which defines at least one runner of the system from which molten magnesium alloy is injected into the die cavity, and wherein the flow system is of a form whereby it provides for control of metal flow velocities therein whereby substantially all of the metal flowing throughout the die cavity is in a viscous or semi-solid state.

18. A process according to claim 17, wherein the system is provided with at least one controlled expansion region whereby metal flow spreads laterally in said region, with respect to its direction of injection, with a resultant reduction in its flow velocity relative to its velocity in the runner.

19. A process according to claim 18, wherein the controlled expansion region as provided as at least one gate through which the metal is able to flow from the runner to the die cavity.

20. A system according to claim 19, wherein the gate and runner are formed such that an effective cross-sectional area of flow through the gate exceeds an effective cross-sectional area of flow through the runner whereby the molten metal has a velocity through the effective cross-sectional area of flow through the runner which exceeds its velocity through the gate.

21. A process according to claim 20, wherein the cross-sectional area of flow through the gate exceeds the effective cross-sectional area of flow through the runner to an extent resulting from ratio of those areas in the range of about 2:1 to 4:1.

22. A process according to claim 18, wherein the controlled expansion region is defined at least in part by and within the die cavity, by surfaces defining the cavity adjacent a site at which metal enters the cavity.

23. A process according to claim 22, wherein there a gate is provided at the site, with the gate providing an outlet end of the runner without defining part of the controlled expansion region.

24. A process according to claim 22, wherein there a gate is provided at a site, with the gate defining part of the controlled expansion region.

25. A process according to any one of claims 18 to 24, wherein provision of the controlled expansion region is achieved by a step-wise increase in cross-section from the effective cross-section of the runner, whereby there is a step-wise reduction of metal flow velocity in said region.

26. A process according to any one of claims 18 to 24, wherein the controlled expansion region progressively increases in cross-section in the direction of metal flow therethrough, whereby there is a progressive reduction in metal flow velocity in said region.

27. A process according to any one of claims 17 to 26, wherein the system is operable to achieve a velocity of molten metal through the runner with the range of about 140 m/s to 165 m/s.

28. A process according to claim 27, wherein the velocity in said range is about 150 m/s.

29. A process according to claim 27 or claim 28, as appended to any one of claims 17 to 26, wherein the system is operable to achieve a velocity of flow of molten metal through the controlled expansion region which is about 25% to 50% less than the velocity of flow through the runner.

30. A process according to claim 29, wherein the velocity through the controlled expansion region is about two-thirds of the velocity through the runner.

31. A process according to any one of claims 17 to 29, wherein the runner has a designed cross-sectional area which substantially defines the effective cross-sectional area of flow therethrough.

32. A process according to any one of claims 17 to 31, wherein filling of the die cavity is achieved by moving fronts of semi-solid metal.